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DATE: 3 September 2005

TO: Jim Buckley, Jerry Frisch, ASTM Masonry Fireplace Test
Method Committee members

CC: Tom Stroud, John Crouch, Dan Henry

FROM: Ben Myren

RE: MASONRY FIREPLACE R&D UPDATE

Thus far, we have done three tests – all aborted - on the masonry fireplace Jim and Jerry built in our lab. The unit was described as a "50's era 36", and is thought to be representative of the fireplaces built in the 1950's and 1960's. Our work with the unit to date has focused on burning the present fuel crib sequence developed for the zero clearance fireplace ASTM test method in the masonry fireplace. Thus far our efforts have not been very successful because the fire is well on its way to going out before the second fuel crib would be loaded. Fuel load adjustments (pokes) only seem to prolong the inevitable. What follows is a brief description what was done in each test.

Test 1

This test used the grate from the Heatilator E 36, the unit being used as the base unit for the development of the ASTM fueling protocol for zero clearance fireplaces. Thus, the kindling brands used were exactly the same as presently being used in the E 36. The Masonry (M 36) unit also had a door frame installed on it, which resulted in the floor of the firebox being about 5" below the door opening. The 2 kindling brands burned in their usual fashion, but the first fuel crib did not ignite very well and the fire was well on its way out long before it was time to load the second fuel crib. The test was aborted before the second fuel crib would have been loaded.

Our thoughts at the end of the test were as follows:

1. The door frame was some how affecting the air flow so the door was removed and one could see that the coal bed color perked up a bit.
2. The masonry unit was acting like a big heat sink and would need more kindling to get the first fuel

- crib to ignite and burn properly.
3. The grate was too short (not deep enough) so the fuel was too far back in the firebox.

Test 2

This test used a much wider and deeper grate so the kindling brand was much larger. The brand in the first test weighed just over 4 lbs. The brand used in this test weighed over 7 lbs. The fuel load was a bit longer due to grate geometry. And the door frame was totally removed from the fireplace. The results were basically the same. The larger brand took a little long to get going due to spacing issues, but once the fire got going the brand really burned very nicely. The first fuel crib ignited reasonably well, but the fire faltered and the test was aborted at 90 minutes. At 90 minutes there was 3.8 lbs of fuel left from the first fuel crib which originally weighed 11.7 lbs. This yielded an approximate dry burn rate (DBR) for the first crib of about 2.0 kg/ hr. (The target DBR is roughly 3.0 kg/ hr.)

Our thoughts at the end of this test were as follows:

1. The spacing of the 2 x 2's in the second brand hindered the ignition of the brand and so may have impacted the ignition of the first fuel crib.
2. The top of the horizontal fuel supports in the new grate were 5" off the floor of the firebox, so the fuel was farther away from the coal bed than in the E 36 where the top of the horizontal fuel supports are 3" above the floor of the firebox. So once the coal bed starts to burn away the fire starts to immediately die back in the M36.

Test 3

We increased the spacing between the 2x2's in the second brand and cut the legs on the grate so that the top of the horizontal fuel supports in the grate were the same height as the fuel supports in the grate from the E 36 (3"). The kindling brands burned much better and we loaded the first crib at 11 minutes (as opposed to 19 minutes with the previous test) and the first fuel crib ignited very nicely. But as in the previous 2 tests, once the coal bed started to burn away, the fire began to falter and die out. This time we aborted the run at 85 minutes – all flames had gone out at 83 – 84 minutes – and 4.2 lbs of fuel were left in the unit. This time the DBR for the first fuel crib was under 2.0 kg/hr.

Our thoughts after this test are as follows:

1. The grate presently being used has more horizontal fuel supports than the grate from the E 36. The extra fuel supports are reducing the air flow up through the grate and so are at least partially responsible for the fire going out.

2. Any hope of using the present fueling protocol developed for zero clearance fireplaces in masonry units is probably gone. We could try using a third kindling brand to increase the amount of coals when the first fuel crib is loaded and we could use a grate with a configuration similar to that of the grate from the E 36, but I think we are really just dodging the real issue, i.e., the zero clearance fuel crib will have to be revised for masonry fireplaces.

It definitely looks like we are going to have to revise the fuel crib sequence for Masonry fireplaces and use more, smaller pieces to get the performance and results we are looking for. (Here I assume our target is comparable to the target we had for the zero clearance units: an emissions rate of 12-14 g/kg, a DBR of about 3.0 kg/hr and a test length of 3 - 3.5 hours.)

This masonry unit does burn differently than the zero clearance units I have worked with thus far. Whether the difference is due to mass, flue size (10x10" ID), air to fuel ratio, other design factors or all of the above is unknown at this time. But the difference is definitely there. My first thought was to use the earlier "Bonfire" crib sequence, but I think that might be too much fire and would still be too clean. But I do think that a place to start would be with a first fuel crib that is all 2x4's because it is the 4x4 in the present first fuel crib that is not burning. That should impact what happens with the first fuel crib and will indicate just how much work will be necessary to develop a reliable, repeatable fuel crib sequence for masonry units. So, that will be what we attempt next. That information should provide some very useful information for discussion at RTP.

Attached are two photos that show the size difference between the kindling brands used in Test 1 and the larger brands used in Test 3.

Let me know if you have any thoughts, ideas or comments.

Regards, Ben